United States Department of the Interior

FISH AND WILDLIFE SERVICE
1208-B Main Street
Daphne, Alabama 36526

Rec'd 12/11

IN REPLY REFER TO:

December 2, 2004

Mr. Jon M. Loney
NEPA Administration
Environmental Policy and Planning
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Dear Mr. Loney:

This document is the U.S. Fish and Wildlife Service's (Service) programmatic biological opinion based on our review of the proposed Wilson Hydro Plant Modernization of Hydroturbine Project located in Lauderdale and Colbert Counties, Alabama, and its effects on these endangered mussel species: cracking pearlymussel (*Hemistena lata*), fanshell (*Cyprogenia stegaria*), orangefoot pimpleback (*Plethobasus cooperianus*), pink mucket pearlymussel (*Lampsilis abrupta*), ring pink (*Obovaria retusa*), rough pigtoe pearlymussel (*Pleurobema plenum*), and white wartyback pearlymussel (*Plethobasus cicatricosus*) per Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your Draft Environmental Assessment (EA) entitled Wilson Hydro Plant Modernization of Hydroturbines (HMOD) and cover letter dated April 30, 2004 requesting formal consultation for this proposed action was received on May 6, 2004.

Included in the Draft Wilson HMOD EA are three mussel species and one snail species designated as Non-essential Experimental Populations (NEP) that have been reintroduced to the Wilson Dam tailwaters. They are the endangered birdwing pearlymussel (*Lemiox rimosus*), dromedary pearlymussel (*Dromus dromas*), oyster mussel (*Epioblasma capsaeformis*), and Anthony's riversnail (*Athearnia anthonyi*). These species have similar biological and habitat requirements and similar historic distributions as the aforementioned endangered mussel species. The 3 NEP mussel species share a similar life cycle, population structure and dynamics, and behavioral patterns with the 7 mussels listed above. For these reasons, the Service believes the reasonable and prudent measures, terms and conditions, and conservation recommendations developed for this project would benefit not only listed species in this reach but also these four NEP species.

This programmatic biological opinion is intended to analyze the program-level effects of incidental take of the above listed aquatic species as a result of proposed hydro plant modernization of hydroturbines downstream of Wilson Dam in Lauderdale and Colbert Counties, Alabama. In addition, however, future shoreline stabilization activities will be carried out under

this program at presently undetermined locations within the action area, as a result of the proposed modernization (that fit within the scope of the program as defined below in the **DESCRIPTION OF PROPOSED ACTION** section). The effects of these activities on the above listed aquatic species will also undergo separate section 7 analysis, and this analysis will be appended to this document in Appendix D. Prior to undertaking any bank stabilization activities that could affect Federally listed species, the Tennessee Valley Authority (TVA) will consult with the Service and will make certain that each stabilization action does not jeopardize the continued existence of the above listed aquatic species. Currently, no critical habitat has been proposed or designated for the seven aquatic species involved in this consultation, so none would be affected by the proposed action. In addition, the analysis will progressively track the additive impacts of all individual (permitting) actions to prevent the aggregated impacts from exceeding those anticipated for the total program. The anticipated format for these individual analyses can be found in Appendix C.

This programmatic biological opinion is based on information provided in an informal meeting held between TVA and the Service's Daphne, Alabama Ecological Services Field Office personnel on June 12, 2003 in Daphne, Alabama. Information provided in TVA's project proposal letter, dated July 7, 2003, further aided our understanding of this project. Additionally, the information provided in TVA's April 2004 Draft Wilson HMOD EA greatly improved the Service's understanding of this project and its potential effects to the environment and on federally endangered aquatic species. The Service acknowledged receipt of TVA's April 30, 2004 cover letter attached to the Draft Wilson HMOD EA requesting formal consultation and we concurred with the need for such consultation in a letter to TVA dated June 3, 2004. Telephone and/or electronic mail correspondence with TVA biologists (John Jenkinson, Stephanie Chance, Peggy Shute), Alabama Department of Conservation and Natural Resources (ADCNR) malacologist (Mr. Jeff Garner) and Service biologists (Messrs. Joe Johnston, Ken Graham, Bob Butler, Paul Hartfield) have occurred throughout this consultation. Field investigations and site inspections of current riverbank conditions as well as inspections of on-going riverbank stabilization efforts occurring downstream of Wilson Dam were conducted on June 10, 2004 by Mr. Damien Simbeck (TVA Pickwick Watershed Team member/biologist), Ms. Stephanie Chance (TVA malacologist), and Mr. Rob Hurt (Service biologist).

Consultation History

June 12, 2003: Meeting between TVA and Service personnel at Service's Daphne, Alabama Field Office to discuss the Wilson HMOD project.

July 7, 2003: TVA provided to Service Wilson HMOD Project Proposal Letter.

April 2004: TVA produced and provided to Service the Draft Wilson HMOD EA.

June 3, 2004: Service acknowledged receipt of TVA's April 30, 2004 cover letter and Draft Wilson HMOD EA with a letter to concurring on their need to consult regarding the proposed action.

November 3, 2004: The Service contacted TVA via electronic mail message requesting additional information regarding the claim TVA made on page 11 of the Draft Wilson Hydro Plant Modernization of Hydroturbines EA regarding water quality conditions, namely dissolved oxygen and temperature conditions and their effects to the tailwaters below Wilson Dam. The Service asked for clarification and requested water quality data supporting TVA's claim made in their draft EA.

November 11, 2004: TVA responded to the Service's November 3, 2004 electronic mail message via electronic mail. TVA provided dissolved oxygen and water temperature data in the form of graphs and a brief summary interpreting the data.

FWS Log No.: 05-0061 **Application No.**: N/A
Date Started: May 6, 2004 **Ecosystem**: Lower Tennessee / Cumberland
Applicant and Action Agency: Tennessee Valley Authority
Project Title: Wilson Hydro Plant Modernization of Hydroturbines (HMOD)
County(s): Lauderdale and Colbert

TVA produced a list of 21 aquatic animal species known from within 15 miles downstream of Wilson Dam that may potentially be affected by the proposed modernization activities (Table 1). The list also includes all known federal-listed aquatic species found in both Colbert and Lauderdale Counties, Alabama. TVA determined that 9 of the federally endangered species in the list were present in the project area. TVA also identified two mussel species, the cracking pearlymussel and the fanshell, as "Maybe" being located in the project area. Therefore, we have included these two species in the list of species potentially impacted by this project.

As above, four of the 11 total endangered species known or suspected to be located within the project area have been designated as NEP. No living individuals of these species have been observed in the Wilson Dam tailwaters reach of the Tennessee River in over 50 years. The reintroduction of these species at this site during 2003 and 2004 was an attempt to re-seed these species into a portion of their historic range. It may take several years before these reintroduction activities can be fully assessed and determinations made about whether there are reproducing populations of these species. As per Section 10(j) of the ESA, the 4 NEP species identified in this project are to be considered as proposed species; therefore, they are not afforded protection under the ESA.

The remaining 10 species on TVA's list are known from within 15 miles of Wilson Dam; however, they are not present in the project area and therefore would not be affected by the proposed action. There will be no further discussions in this programmatic biological opinion of these 10 species or the NEP species that have been reintroduced to the Wilson Dam tailwaters. We have, however, included the 4 NEP species accounts in Appendix A. Additionally, there are no critical habitat designations for any of the federally listed species in the vicinity of the proposed activities.

Table 1. Federal- and state-listed aquatic animal species known from within fifteen miles downstream from Wilson Dam (TRM 259) and additional federal-listed aquatic species reported from Colbert and Lauderdale Counties, Alabama.

Common Name	Scientific Name	Federal Status	State Status	Present in Project Area?
Crustacean				
Alabama cave shrimp	*Palaemonias alabamae*	E	T	No
Native Mussels				
Birdwing pearlymussel	*Lemiox rimosus*	E	P	Yes ®
Cumberlandian combshell	*Epioblasma brevidens*	E	P	No
Cracking pearlymussel	*Hemistena lata*	E	P	Maybe
Dromedary pearlymussel	*Dromus dromas*	E	P	Yes ®
Fanshell	*Cyprogenia stegaria*	E	P	Maybe
Orangefoot pimpleback	*Plethobasus cooperianus*	E	P	Yes
Oyster mussel	*Epioblasma capsaeformis*	E	P	Yes ®
Pink mucket pearlymussel	*Lampsilis abrupta*	E	P	Yes
Pyramid pigtoe	*Pleurobema rubrum*	-	P	Yes
Ring pink	*Obovaria retusa*	E	P	Yes
Rough pigtoe pearlymussel	*Pleurobema plenum*	E	P	Yes
Sheepnose	*Plethobasus cyphyus*	C	P	Yes
Slabside pearlymussel	*Lexingtonia dolabelloides*	C	P	No
Spectaclecase	*Cumberlandia monodonta*	C	P	Yes
Turgid blossom pearlymussel	*Epioblasma turgidula*	E	P	No
White wartyback pearlymussel	*Plethobasus cicatricosus*	E	P	Yes
Snail				
Anthony's riversnail	*Athearnia anthonyi*	E	-	Yes ®
Fishes				
Alabama cavefish	*Speoplatyrhinus poulsoni*	E	P	No
Slackwater darter	*Etheostoma boschungi*	T	P	No
Spotfin chub	*Cyprinella (=Hybosis) monacha*	T	P	No

C – identified candidate, E – endangered, T – threatened, P – protected, ® – NEP species

PROGRAMMATIC BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

TVA proposes to rehabilitate and modernize (hydromodernization/HMOD) eleven generating units (#1-8 and #19-21) at Wilson Dam and Hydro Plant. The **ACTION AREA** for the purpose of this opinion encompasses an area 0 feet upstream and approximately 15 river miles downstream of the Wilson Dam and Hydro Plant, located at Tennessee River Mile (TRM) 259.4.

The **ACTION AREA** is further explained and discussed in the "Effects of the Action" section of this consultation. Also included within this **ACTION AREA** are the equipment staging/lay down areas and adjacent riparian habitats, also the riverbanks, some of which will require contouring to prevent bank scour. Based on stream bank survey data collected, TVA has estimated that a total of 10 miles of riverbank and island shoreline within the total 15 river mile **ACTION AREA** would be potentially impacted by the proposed stabilization activities. From this projected figure and based on the proposed methods of implementing the stabilization efforts (i.e. via barge and tug boat from the river), the extent of area potentially affected by the proposed stabilization activities has been determined. The barges TVA proposes to use for placement of riprap are approximately 33 feet wide. One barge carries the riprap, while the second barge carries a tracked excavator. Thus the figure of 66 feet was based on the total width of the two barges, aligned side-by-side, and positioned by the tug boat adjacent and perpendicular to the shoreline proposed for stabilization. Therefore, using the 66 feet of width figure multiplied by the 10 miles (~52,800 feet), the total river bottom area that could be affected is approximately 80 acres.

By modernizing the hydro turbine units, TVA would maintain continued safe and reliable peak power generation, improve operational efficiency, provide additional megawatts (MW) of generating capacity, and increase net income from the power system. Units #9-18 were hydromodernized between 1994 and 2000. Due to the age of the remaining eleven units, TVA must rehabilitate them to maintain a safe and reliable generating capacity. Upgrading these units would improve their efficiency. Gaining capacity and increasing efficiency at Wilson Hydro Plant through these improvements would help TVA meet projected peak power demands in the Tennessee Valley. According to TVA's final environmental impact statement, Energy Vision 2020, completed in 1995, one of the agency's focal points in increasing their generating capacity was the modernization, improvements, and upgrades at TVA dams.

According to the hydrologic modeling TVA utilized for predicting alterations in stream flow through Wilson Dam, the proposed modernization activities would increase current total discharge from 104,000 cubic feet per second (cfs) to 110,000 cfs at full HMOD build out. The pre-HMOD generating capacity is 629.8 MW; the present existing generating capacity (partial HMOD) is 670 MW; and the proposed generating capacity at completed HMOD status would be 742 MW.

As a result of the flow volume increase through Wilson Dam, TVA hydrologists predict tailwater elevations would increase slightly in areas downstream from the Wilson Hydro Plant. There would be nominal increases in flow velocity occurring with the Wilson HMOD, generally 0.1 ft./sec. It is predicted that maximum increases would be less than 0.2 ft./sec. compared to the present flow velocities.

Essentially all proposed activities for improving, replacing, or rehabilitating equipment at Wilson Hydro Plant would occur inside the plant, transformer areas and some previously disturbed areas (for lay down) on the plant site. The crane located on-site would be utilized to replace the turbines. A 100-ton crane would be used for the switchyard transformer replacement work, and a 20-ton crane ordinarily used in the powerhouse may also be used during the construction. These cranes would be brought to the site. The lay down areas, located outside, would house some of the larger components being removed and/or replaced.

The proposed work is scheduled to begin in year 2005 and continue through year 2014. While some hydro turbines/units are being replaced, the other units may be operated for slightly longer duration to meet operational objectives.

The used and outdated equipment being replaced would be properly removed from the site and disposed of by appropriate regional, local firms and recycled, or designated as eligible historic equipment and retained by TVA as part of the agency's historical collection. Other equipment removed may be utilized as replacement parts/components for other TVA hydro plants. Waste oil, hydraulic fluid, grease, and any other hazardous materials, such as asbestos and mercury would be appropriately disposed of and in accordance with state and federal regulations.

As required by the Alabama State Historic Preservation Officer (SHPO), TVA has committed, under both the proposed Wilson HMOD project and the No Action Alternative, to stabilize shorelines located downstream of Wilson Dam and Hydro Plant. TVA has discussed these issues with the SHPO and a plan to protect specific archaeological sites in the Wilson Tailwater area from further erosion has been developed. This plan includes implementation guidelines on the placement of riprap. The following steps are to be implemented to minimize impact to cultural resources located on TVA administered lands: (1) All riprap placement would be conducted from barges when the water level is at full (summer) pool elevation. Shallow draft barges (typically 3 to 4 feet) would be used for this work, moved to and from the work site by a shallow draft tug with a propeller extending no more than 4 feet below the water surface. When water depth is less than 6 feet in the work area, riprap placement would be performed from a smaller, self-propelled barge that can adjust the trim of the prop to operate in shallow water. (2) Site preparation for riprap placement would entail the selective removal of vegetation from the surface of the eroding bank and the storage of such material on top of the bank or on the barge. Trees located in the area to be covered by riprap would be cut at the soil level, leaving the stump and root mass intact. Bank contours would remain relatively unmodified (no bank sloping) and no earthen keyway excavated at the toe of the bank slope. When needed, filter fabric (erosion control blanket) would be placed by hand over the bank surface prior to placement of riprap. This fabric would help conceal protruding archaeological materials, as well as minimize future soil loss from the site. (3) Where possible, all riprap would be placed above low water (winter)

pool elevation. The riprap slope would be no less than 1.5:1 (i.e. 1.5 feet in width for every 1 foot of height).

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/Critical Habitat Description, including Life History and Population Dynamics

Hemistena lata (Rafinesque 1820)
Cracking Pearlymussel

The **cracking pearlymussel**, [*Hemistena* (=*Lastena*) *lata*], was listed as a federal endangered species in 1989 (USFWS 1989a). It once occurred in the Cumberland, Ohio, and Tennessee river systems from Ohio and Illinois south into Alabama, Tennessee, and Virginia (Parmalee and Bogan 1998). Since the early 1970s, this species has been encountered in the Clinch, Elk, and Powell Rivers, and in the mainstem Tennessee River downstream from Pickwick Dam (USFWS 1991). Critical habitat has not been identified for this species.

All populations of this species appear to be declining (USFWS 2003). The population losses in this species probably were due to the direct impacts of impoundments, pollution, and habitat alteration, and the indirect impacts associated with the reduction or elimination of its larval host species by these same factors (USFWS 1989b). In 2001, the U.S. Fish and Wildlife Service included the cracking pearlymussel in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (USFWS 2001). During 2003-2004, this species was reintroduced into that reach of the Tennessee River. No data currently exists on the success of this effort. However, future surveys would verify if these reintroductions result in reproducing populations of this endangered species.

The cracking pearly mussel typically is found deeply buried in mud, sand, and fine gravel substrate in medium-sized rivers (Parmalee and Bogan 1998). The fish hosts for this species are presently unknown (Parmalee and Bogan 1998; USFWS 1991); however, recent experiments indicate that whitetail shiner (*Notropis galacturus* [=*Cyprinella galactura*]), streamline chub (*Erimystax dissimilis*), central stoneroller (*Campostoma anomalum*), and banded sculpin (*Cottus carolinae*) could each be possible hosts (Jones and Neves 2000).

Available records indicate that the cracking pearlymussel still survives in four waterbodies in the Tennessee River: flowing reaches of the Tennessee River downstream from Pickwick and Wilson dams, and in the Elk River both downstream from Fayetteville and between Fayetteville

and Tims Ford Dam (records stored in TVA Heritage database). The cracking pearlymussel is considered to occur in large river through large creek habitats.

Cyprogenia stegaria (Rafinesque 1820)
Fanshell

The **Fanshell** (*Cyprogenia stegaria*) mussel was listed as a federal endangered species in 1990 (USFWS, 1990). Originally, the fanshell occurred in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries; however, reproducing populations now occur only in the Clinch River, Tennessee and Virginia, and the Green and Licking Rivers, in Kentucky (USFWS 1991). Results from incidental collections indicate that non-reproducing populations or individuals persist in some suitable habitats within the original range, including Tygarts Creek in Kentucky, Cumberland and Tennessee Rivers in Tennessee, Muskingum River in Ohio, Wabash River in Illinois and Indiana, East Fork White and Tippecanoe Rivers in Indiana, and Kanawha River in West Virginia. The increasing infrequency of this species in survey results supports the conclusion that it is declining in least many parts of its present range (USFWS 2003). Identified causes for the decline of the fanshell include the construction and operation of reservoirs and other impacts on water and substrate quality. No critical habitat has been designated for this species (USFWS 1991).

Typical fanshell habitat is gravel or cobble substrate in medium to large rivers (USFWS 1991). Potential fish hosts include tangerine darter (*Percina aurantiaca*), blotchside logperch (*Percina burtoni*), and greenside darter (*Etheostoma blennioioides*) (Jones and Neves 2002).

Within the last 30 years, the fanshell has been found in scattered locations along the length of the Tennessee River and in the Clinch River. During this time period, this species has been encountered in five waterbodies in the Tennessee River, all mainstem tailwaters (downstream from Kentucky, Pickwick, Wilson, Guntersville, and Watts Bar Dams). Most of these occurrences are based on sightings of single individuals; however, several members of this species have been observed in the Pickwick Dam tailwater. In this evaluation, the fanshell is considered to occur in large and medium rivers.

Plethobasus cooperianus (Lea 1834)
Orangefoot Pimpleback

The **orangefoot pimpleback** (*Plethobasus cooperianus*) mussel was listed as an endangered species in 1976 (USFWS, 1976). The historic distribution of this species included parts of the Ohio, Cumberland, Kanawha, Tennessee, and Wabash Rivers (USFWS 1984). Since the early 1970s, the orangefoot pimpleback has been found in the lower Ohio River (Miller, Payne, and Siemsen, 1986), in the middle reach of the Cumberland River (Parmalee et al., 1980) and in the

tailwaters of Kentucky, Pickwick, Wilson, Guntersville, and Ft. Loudoun Dams on the Tennessee River (USFWS 1984, Parmalee and Bogan 1998, TVA 1999). Critical habitat has not been identified for this species.

The increasing rarity of this species during surveys supports the conclusion that it is continuing to decline (USFWS 2003). The reasons for its decline are not totally understood but, due to its longevity and sedentary nature, the orangefoot pimpleback would be especially vulnerable to stream perturbations such as impoundment, siltation, and pollution (USFWS 1984).

The orangefoot pimpleback is a large-river, shoal species, typically found in sand and coarse gravel. No fish host for this species has been identified (Parmalee and Bogan 1998).
In recent years, the orangefoot pimpleback has been encountered in six waterbodies in the Tennessee River. All six of these waterbodies are flowing reaches of the mainstem Tennessee River downstream from the following dams: Kentucky, Pickwick, Wilson, Guntersville, Watts Bar, and Ft. Loudoun. The records from most of these waterbodies are based on sightings of just a few individuals; however, this species has been encountered fairly often in the river downstream from Pickwick Dam (USFWS 1984, Jenkinson 1987, TVA unpublished data).

Lampsilis abrupta (Say 1831)
Pink Mucket Pearlymussel

The **pink mucket pearlymussel** (*Lampsilis abrupta* = *L. orbiculata*) was added to the list of federal endangered species in 1976 (USFWS 1976). This species once occurred in a variety of cobble, gravel, and other substrate types in medium to large rivers in the Ohio, Cumberland, Tennessee, and middle Mississippi River systems (Parmalee and Bogan 1998). In recent years, pink mucket pearlymussels have been found at locations scattered across the former range where suitable habitat still exists for a variety of riverine mussel species. These locations extend from the Kanawha River, West Virginia; west to the Gasconade River, Missouri; south to the Black River, Arkansas; and east to the Tennessee and Cumberland River basins (USFWS 1985). The most upstream site in the Tennessee River watershed where this species has been found recently is the Clinch River, in Claiborne County, Tennessee. As of 2000, the U.S. Fish and Wildlife Service considered this species to be declining (USFWS 2003); however, continuing routine encounters of low numbers suggest that most populations are relatively stable. The causes of the decline for this species are not totally understood but may be related to impoundments, siltation, and pollution (USFWS 1985). Critical habitat has not been designated for this species.

Suggested fish hosts for the pink mucket pearlymussel are the sauger, *Stizostedion* (= *Sander*] *canadense*, and freshwater drum, *Aplodinotus grunniens* (Fuller 1974). Those fishes, however, may be the hosts just for the closely-related Higgins' Eye, *Lampsilis higginsi* (Parmalee and Bogan 1998).

Within the last 30 years, the pink mucket pearlymussel has been encountered in nearly all tailwaters of the mainstem Tennessee River dams and in parts of Bear Creek and the Clinch, French Broad, and Holston Rivers (USFWS 1985, TVA Heritage database and contributing sources). The pink mucket pearlymussel is known from 14 waterbodies in the Tennessee River: 8 mainstem tailwaters (downstream from Kentucky, Pickwick, Wilson, Guntersville, Nickajack, Chickamauga, Watts Bar, and Fort Loudoun Dams), 4 tributary tailwaters (downstream from Bear Creek, Norris, Cherokee, and Douglas Dams), and 2 mainstem reservoirs (Kentucky and Wheeler). Although always uncommon or rare, this species is encountered most often in the flowing mainstem areas downstream from Pickwick and Guntersville Dams. Its continued presence in pooled mainstem waterbodies and in tributary dam tailwaters is often limited to sightings of single, often old, individuals. The pink mucket pearlymussel is considered to typically occur in large river habitats.

Obovaria retusa (Lamarck 1819)
Ring Pink

The **ring pink** (*Obovaria retusa*) mussel was listed as a federal endangered species in 1989 (USFWS 1989). Ring pinks once occurred throughout much of the Ohio, Cumberland, and Tennessee river systems in parts of Pennsylvania, Ohio, West Virginia, Indiana, Illinois, Kentucky, Tennessee, and Alabama (USFWS 1991). Since the early 1970s, this species has been found only in the Tennessee River downstream from Kentucky and Pickwick Dams, in the middle reach of the Cumberland River in central Tennessee, in the middle reach of the Green River in Kentucky, and in the Kanawha River in West Virginia. Critical habitat has not been designated for this species.

The increasing rarity of encounters with this species supports the conclusion that its populations are declining (USFWS 2003). The identified reason for the decline of this species is the apparent conversion of big river habitats to impoundments (USFWS, 1991).

Typical habitat for this species is gravel and sandy substrates of large rivers. No fish hosts have been identified for this species (USFWS 1991, Parmalee and Bogan 1998).

During the past 30 years, live specimens of the ring pink have been encountered in three waterbodies in the Tennessee River: the mainstem Tennessee River downstream from Kentucky and Pickwick dams, and Pickwick Reservoir not far downstream from Wilson Dam. All three of these occurrences represent very few, older individuals. This species is considered to occur in large river habitats.

Pleurobema plenum (Lea 1840)

Rough Pigtoe Pearlymussel

The **rough pigtoe pearlymussel** (*Pleurobema plenum*) was added to the list as endangered in 1976 (USFWS 1976). The original distribution of this species probably included the Ohio, Cumberland, and Tennessee Rivers and their larger tributaries; however, records from Kansas and Arkansas have been attributed to this species (Parmalee and Bogan 1998). Since the early 1970s, the rough pigtoe has been found alive in the Barren and Green Rivers in Kentucky, and in the Clinch, Cumberland, and Tennessee Rivers in Tennessee (USFWS 1984). Critical habitat has not been identified for this species.

The increasing scarcity of encounters with this species (at least in the Tennessee River system) supports the conclusion that it is declining (USFWS 2003). The reasons for its decline are not totally understood but, due to the longevity of most mussel species, they are especially vulnerable to stream perturbations such as impoundments, siltation, and pollution (USFWS 1984).

The rough pigtoe typically is found in firmly packed sand and gravel. The fish host for this species has not been identified (Parmalee and Bogan 1998).

In recent years, the rough pigtoe has been encountered in six waterbodies in the Tennessee Valley: four flowing reaches of the mainstem Tennessee River downstream from Pickwick, Wilson, Guntersville, and Watts Bar Dams; and in Pickwick and Wheeler Reservoirs. Both of the reservoir records came from the upstream ends of those waterbodies, very close to the identified extent of the adjacent flowing water areas. This species is considered to occur, typically, in large river habitats.

Plethobasus cicatricosus (Say 1829)
White Wartyback Pearlymussel

The **white wartyback pearlymussel** (*Plethobasus cicatricosus*) was listed as an endangered species in 1976 (USFWS 1976). This species originally occurred in the Cumberland, Ohio, Kanawha, Tennessee, and Wabash Rivers (Parmalee and Bogan 1998; USFWS 1984). Since the early 1970s, the white wartyback has been found in the Tennessee River downstream from Pickwick and Wilson Dams. Only a few large, old individuals have been encountered downstream from Pickwick Dam (USFWS 1984, Jenkinson 1987) but a few young specimens have been found recently in the Tennessee River downstream from Wilson Dam (Garner and McGregor 2001). No critical habitat has been designated for this species.

The increasing rarity of this species during surveys of suitable habitat supports the conclusion that it is continuing to decline (USFWS 2003). The reasons for its decline are not totally

understood but, due to its longevity and sedentary nature, it would be especially vulnerable to stream perturbations such as impoundment, siltation, and pollution (USFWS 1984).

The white wartyback is a big-river species, inhabiting shoal and riffle areas with sand and gravel substrate (Parmalee and Bogan 1998, USFWS 1984). Fish hosts are unknown, but the sauger (*Stizostedion* [=*Sander*] *canadense*) is reported to be the host for *Plethobasus cyphyus*, a closely related species (USFWS 1984).

Recent records for the white wartyback are known from the mainstem Tennessee River downstream from Pickwick and Wilson Dams. This species is considered to occur in large river habitats.

The following table includes past biological opinions completed in the vicinity of the proposed action that involved some of the same species as affected by the proposed action.

Table 2. Biological opinions completed in the last 10 years by the Daphne Field Office for those projects in the vicinity of the Wilson HMOD project.

BO	SPECIES	YEAR	MONITORING REPORTS		PROJECT ACTIVE YES/NO
			RECEIVED	NOT RECEIVED	
Patton Island Bridge Project	*Lampsilis abrupta* *Pleurobema plenum* *Plethobasus cooperianus* *Plethobasus cicatricosus*	1994		X	NO, work completed by 2003
City of Florence, Alabama's Treated Sewage Outfall; Tennessee River Mile 254.2	*Lampsilis abrupta* *Pleurobema plenum*	1997	N/A	N/A	NO, work completed by 1999

N/A – Daphne FO had no monitoring requirements associated with this BO.

Analysis of the species/critical habitat likely to be affected

No critical habitat designations exist for any federally-listed species in the tailwaters of Wilson Dam and Hydro Plant, therefore no critical habitat would be affected by the proposed action.

ENVIRONMENTAL BASELINE

The Tennessee River historically supported a diverse and abundant aquatic fauna, including numerous species of fish and freshwater mussels. However, the Tennessee River mainstem is presently impounded by nine dams. These dams have effectively converted the original riverine

habitat into a series of lake-like pools. These modifications have drastically changed the native aquatic fauna.

Freshwater mussels are sedentary animals. Unless their habitat is de-watered or they are dislodged from the stream bottom, they remain in one place once they settle after detaching from their host. Most species require riverine habitats and occur in shoal and riffle areas having continuous flow over silt-free substrates of mixed sand/gravel/cobble. Stream currents oxygenate the water, sweep the bottom clean of silt and other fine particulate matter, and provide a continuous supply of suspended forage material. Mussels are filter feeders, siphoning algae, plankton, and detritus from the water. Because of their sedentary nature feeding habits, mussels tend to accumulate certain pollutants such as heavy metals and pesticides. Thus, they are thought to be excellent indicators of water quality.

Mussels become sexually mature at three or four years of age and exhibit a unique life cycle. Males release sperm into the water column which are taken in by females during normal siphoning activity. Fertilized eggs are held in specialized gill pouches (marsupia), where they develop into the larval stage (glochidia). Mature glochidia are released separately or in masses (conglutinates), where they drift with stream currents. Within three or four days, the glochidia must attach to suitable fish hosts. Recent studies have shown that some mussel species exhibit a high degree of fish host specificity; some metamorphose only on certain groups or species of fish (Zale and Neves 1982). Glochidia contacting suitable fish hosts encyst on the gills or fins and, after a period of time (depending on water temperatures and other factors), detach as fully developed, free-living juvenile mussels. Due to their small size, the detached juveniles again drift with stream currents; those that settle onto suitable, silt-free substrate survive.

Two reproductive modes have been identified for freshwater mussels. Fertilization of eggs, release of glochidia, and metamorphosis on fish hosts occur from spring through late summer in short-term (tachytictic) breeders. In long-term (bradytictic) breeders, fertilization and glochidial development occur during the summer through fall and early winter, but glochidia are retained in the marsupia and released by females the following year. In streams supporting populations of several bradytictic species, glochidia may be present in the water column year-round, except for the period of gametogenesis.

High mortality is thought to occur at two stages in the life cycle of mussels: attachment to and detachment from the fish host. Those glochidia failing to attach to an appropriate fish host likely settle to the stream bottom and perish or are consumed by various predators. Those attaching to inappropriate fish hosts are likely sloughed off and perish. Metamorphosed juveniles that settle onto unsuitable substrate are also not likely to survive. However, mussels have a high reproductive capacity depending on the size of the individual mussel, hundreds of thousands of glochidia may be released annually by a single female. Because of their high fecundity and long

life spans (some mussel species have been known to live for at least 56 years or longer), low but constant annual recruitment may be adequate to maintain a population.

Construction of dams for hydropower and river navigation, as well as development along much of the Tennessee River have resulted in declines in many aquatic animal populations and extirpation of others. Pollution and siltation have also had significant adverse effects on native aquatic species. Point and non-point discharges from municipal, industrial, and agricultural sources have rendered some tributary streams uninhabitable by many native fauna and have likely had significant impacts on the populations in the mainstem of the Tennessee River. Siltation from agricultural operations, mining, timber harvest, dredging, and construction has contributed to water quality degradation and habitat alteration, and has eliminated populations of both mussels and their essential fish hosts. Silt causes increased turbidity and reduces light penetration in the stream. Natural sedimentation that occurs during annual flooding and seasonal storm events probably does not significantly affect fish and mussel communities; but human activities often create excessively heavy or prolonged silt loads that can severely affect mussels and other aquatic organisms. Prolonged silt input creates a blanketing effect that can cause irritation or clogging of gills and siphons. Excessive sedimentation can also reduce or inhibit feeding, and can eventually smother adult and juvenile mussels. Siltation also has indirect effects on mussels by smothering eggs or larvae of vital fish hosts, rendering fish spawning areas unsuitable and possibly causing fish to abandon previously suitable habitats.

Introduction of exotic species has also contributed to the decline of native freshwater mussel populations. The Asian clam (*Corbicula fluminea*) was introduced into North American water in the 1930's in the Pacific Northwest. By the mid-1970's, this exotic species had spread throughout the United States. Another species, the zebra mussel (*Dreissena polymorpha*), was recently introduced from Europe. It was first reported in the Great Lakes in 1988, and by 1992 had spread to the Ohio, Tennessee, Cumberland, and lower Mississippi Rivers. Both of these species have extremely high reproductive capability, quickly reaching densities of thousands of individuals per square meter. At these densities, they have the ability to filter tremendous quantities of water and plankton, significantly reducing the availability of food for native mussel species. In addition, neither species requires a fish host to complete its life cycle and both species can produce one or more generations per year. Because of these competitive advantages, the decline of native mussel populations in some rivers has been attributed to *C. fluminea* (Clarke 1986). Although *D. polymorpha* has only been present in North America 16 years, it has the potential to replace native mussel populations in the major river systems throughout the Southeast. The extent to which zebra mussels will impact the Tennessee River Basin's freshwater mussel fauna is presently unknown. However, zebra mussels in the Great Lakes have been found attached in large numbers to the shells of live and freshly dead native mussels, and the species has been implicated in the loss of entire mussel beds.

Status of the species within the action area

According to TVA's Draft Wilson HMOD EA (pgs. 22-24), the following information describes what is currently known about the endangered mussel species located downstream of Wilson Dam.

An orangefoot pimpleback was documented in a 1996 photograph from a location downstream of Wilson Dam.

Over the past 25 years, the pink mucket pearlymussel has been found in several places in the Wilson Dam tailwater. When this species is found, it typically accounts for 0.3 to 0.7 percent of the mussel community (Jenkinson and Hickman, 1983). The population/density/abundance of this species in the Wilson Dam tailwater is relatively typical for this species.

Only one ring pink has been found in the recent past downstream of Wilson Dam, in 1992.

The white wartyback pearlymussel is nearly extinct; however during the years between 1997 and 1999, 5 live animals and one empty shell were found in Wilson Dam tailwater.

A rough pigtoe was found in the Wilson Dam tailwater approximately 6 miles downstream of the dam in 1996 and another was found in 1999.

There have been no recent records made for either the fanshell or the cracking pearlymussel in the Wilson Dam tailwater reach of the Tennessee River. However, in 1999, an empty shell of a cracking pearlymussel was found in the lower reaches of the Elk River. Therefore, the possibility exists that one or both of these two mussels could be present in the Wilson Dam tailwater.

Factors affecting species environment within the action area

In addition to hydroelectric generation, various other factors affect environmental conditions of Wilson Dam tailwaters and the listed mussels found there. These factors include, but are not limited to: stormwater runoff from industrial, agricultural, and municipal properties; water withdrawal for water supply facilities; wastewater treatment effluents; commercial navigation; recreational boat use; and both scheduled and unscheduled releases (i.e. flood conditions) of water from Wilson Reservoir.

All of these conditions have the potential for adversely affecting the habitat of freshwater mussels. Excessive water flows, especially during flood events have the potential for dislodging mussels from the substrate and transporting them down-river to unstable, unsuitable habitat.

Flooding usually causes stream/riverbank and channel erosion. The use of the river by barge traffic can also directly impact mussels in the same manner. The prop wash from barges can destabilize river bottom substrates and dislodge mussels living in those substrates. Beyond the direct affect of prop wash, there is the need by the U.S. Army Corps of Engineers (Corps) to promote safe commercial navigation on the river. When deemed necessary, the Corps may dredge the river channel. River dredging activities may adversely affect mussel species by directly removing suitable habitat and/or individuals of the listed species.

Stormwater runoff from towns and cities often carries with it oils, gasoline, hydraulic fluids and other hazardous chemicals that enter the creeks and rivers from roadways and parking lots. These contaminants, along with pesticides/herbicides and other crop-promoting chemicals entering our waterways during rainfall events, can have direct adverse impacts on mussels.

Since 2001, there have been two large mussel kill events that have occurred downstream of Wilson Dam. These events have not yet been directly linked to any particular point source or non-point sources. Post-event mussel surveys conducted by Mr. Jeff Garner, ADCNR malacologist, have focused on extent of mussel kill and not the cause of these events. The mussel kill event that occurred during the summer of 2004 was extensive, covering approximately 5 river miles, from near the lower end of Sevenmile Island (approx. TRM 247.5, secondary channel only), downstream to about TRM 242.5 (personal communication, Garner 2004). When Mr. Garner verified the mussel kill, Alabama Department of Environmental Management (ADEM) representatives were contacted and subsequent water quality data was collected. Since they were contacted, ADEM, the agency responsible for regulating the Clean Water Act within Alabama, has been involved in recording water quality conditions below Wilson Dam. We understand ADEM collected water quality data and that this data is currently under analysis.

EFFECTS OF THE ACTION

The proposed modernization activities (i.e. replacement/upgrading of turbines) at Wilson Dam and Hydro Plant would not directly impact the listed mussel species found downstream from the dam. This statement is based on that fact that the work associated with upgrading/replacing the turbines at the facility would be conducted internally in the dam and would have no effects to the mussels located downstream of the dam. Rather, the effects of the upgrading/removal and replacement of these turbines could result in indirect impacts to mussels. Due to the increase in flow volume through the upgraded/new turbines, water velocities downstream of the dam would increase. Given the current poor and degraded conditions of the riverbanks in much of the tailwater reach downstream of Wilson Dam, the increase in flow would thereby promote, and likely increase erosion of these riverbanks. For some time, TVA has monitored the riverbank erosion and has been addressing these conditions by the placement of riprap (quarried stone) via

use of a barge and excavator. These activities are planned to continue regardless of the upgrades at Wilson Dam and Hydro Plant.

TVA has an interest in reducing non-point source pollution (i.e. siltation/ sedimentation) in the Tennessee River; therefore, it will continue efforts to repair, rehabilitate and stabilize failing, unstable riverbanks and mid-river island shorelines. The Alabama State Historic Preservation Officer (SHPO) also shares an interest in TVA stabilizing failing and degrading riverbanks along the Tennessee River. Since the area downstream of Wilson Dam is an area rich in Native American artifacts and cultural resources, TVA has cooperatively worked with the SHPO and devised a plan to reduce the shoreline/riverbank erosion.

Shoreline/bank stabilization efforts have the potential for directly impacting listed species. Direct, indirect, and cumulative impacts associated with shoreline/bank stabilization are discussed in this document. It is the Service's belief, however, that shoreline/bank stabilization efforts, if designed and implemented properly, generally provide long-term beneficial effects to listed species and other trust resources in the aquatic environment by reducing the potential of soil erosion along rivers, streams, and reservoirs.

Factors to be considered

As proposed, the hydro turbine units and other associated mechanical and electrical components removed from Wilson Power Plant would be placed into pre-designated lay-down/storage areas located at the plant site. These storage areas would house the larger components temporarily. These components are likely to have been maintained by the use of hydraulic fluid or other environmentally hazardous lubricants. Therefore, lubricants, oils, and hydraulic fluids from these components, if left unattended or inappropriately handled, could eventually spill onto the ground and leach into the soil and ground water. Northwest Alabama, in the area of this project, is described as a limestone/karst area, containing features such as sinkholes, sinking streams, and caves. Therefore, it is imperative that the pre-designated lay-down/storage areas be located away from these karst features to avoid the potential for these hazardous materials from reaching ground water.

Several of the endangered mussels discussed above have been found within one mile of Wilson Dam and Hydro Plant. Therefore, any change in water quality or quantity in the dam's tailwaters may potentially affect the mussels located there. The increased flow rate from Wilson Dam could increase shoreline erosion rates, leading to increased turbidity and sedimentation. Moreover, higher flows through the dam and the turbines will increase the withdrawal zone of water from the reservoir, thus potentially affecting the dissolved oxygen and temperature of dam tailwaters. The increase in discharge rate will also decrease the travel time for water moving to downstream reaches. This could potentially result in cooler water temperatures during the

summer due to less time for solar heating to occur. The reduced travel time and increase in water depth in the tailwaters could also reduce reaeration of the water (TVA 2004).

Shoreline erosion caused by the increased flow rate through Wilson Dam would need to be addressed through corrective measures. The typical measure chosen for shoreline/riverbank stabilization has been the strategic placement of riprap along the shore. This activity typically requires the use of excavators (track hoes), barges, and tugboats. In rare cases, where erosion is occurring in close proximity to existing roadways, riprap could be delivered to the banks via a dump truck and placed by excavator or backhoe.

A potential result of placing riprap on the shoreline is an increased rate (velocity) of water flow along the shoreline. When banks are reinforced with a hardened structure, in this case, rock/stone; measurable increases in flow velocity may occur in the near shore area and along the shoreline.

The Service, in cooperation with TVA, through this programmatic biological opinion and consultation, has reviewed from a biological perspective, the standards TVA developed to minimize effects to archaeological sites. From these standards, the TVA and Service have developed additional shoreline stabilization guidelines to avoid effects to listed mussel species located in the tailwaters of Wilson Dam (see Reasonable and Prudent Measures/Terms and Conditions section, below).

Analyses for effects of the action

The following discussion is principally based on information from the environmental consequences sections provided in TVA's Draft Wilson HMOD EA (TVA 2004).

The hydrology models utilized by TVA staff to determine impacts of the proposed turbine upgrade have indicated that a slight increase in flow velocity downstream of the dam would occur. This increase, although slight (going from 0.1 fps to 0.2 fps), could negatively effect the near-shore and bank conditions in the Wilson Dam tailwaters. Shoreline erosion and turbidity could result. These conditions could potentially affect mussel habitat and may alter the behavioral patterns of mussel species. In some extreme cases, mussels could be smothered/buried.

Substantial erosion problems exist in the Wilson Dam tailwaters. Increased water flow through the upgraded hydro turbines could incrementally increase damage at currently eroding downstream sites. However, it is not anticipated that turbine upgrades alone would significantly exacerbate existing erosional areas or create new erosion sites along the riverbank or island shorelines. Furthermore, the results of these incremental flow increases are relatively small

compared to the range of flow this reach of river experiences during flood or spill events from Wilson Dam. Seasonal floods commonly alter the tailwater flows to a much greater extent than the potential minor, short term daily increases likely to occur under the proposed Wilson HMOD project.

Given existing shoreline conditions, TVA recognizes the need for bank stabilizing methods in the tailwater reaches of many of its dam facilities. Based on forecasted variations in flow rate and surface elevation resulting from the upgrade of turbines at Wilson Dam and the hydraulic projections made under this proposal, TVA also acknowledged its responsibility in mitigating the erosion potential along the mid-river island shorelines and riverbanks in the tailwaters of Wilson Dam. Therefore, TVA proposes the adoption and use of its shoreline stabilization program standards that include typical field procedures for protecting and stabilizing shorelines (TVA 2004 – Attachment 1).

Although the proposed use of riprap may potentially increase water velocities along the shorelines, given the current conditions and expected future results of leaving these banks unprotected and exposed to wind and wave action, the Service believes the benefits of stabilizing eroding banks by placing rip-rap would far exceed those potential impacts.

Since the intake structures (penstocks) are located near the mid-depth on the reservoir side of the dam, the new turbines' efficiency, as it relates to flow rate, would expand the withdrawal zone of water from the reservoir. Although the withdrawal zone area would increase as a result of turbine upgrades, water will be drawn from above and below these intakes.

TVA provided water quality data to the Service via an electronic message on November 15, 2004. Based on the data, Wilson Reservoir appears to be weakly stratified during the months of July to September as compared to other reservoirs. Water temperatures tend to be moderated due to Wilson Reservoir's being well mixed during much of the year. Average dissolved oxygen (DO) during the months of July to September for the recorded period (1961 to 1996) remained about 5mg/L. Generally, 5mg/L of DO maintains biological conditions for aquatic species. Rarely do water quality conditions, namely DO and temperature, decline to levels that pose a detrimental effect to the receiving waters or tailwaters area below Wilson Dam. Tailwater DO concentrations dropped below 4mg/L four times over the 35-year period with the lowest recorded DO concentration of 2.4 mg/L during 1965. Once the units are upgraded and given the fact that the intakes are located near the mid-depth of Wilson Reservoir, it is likely the withdrawl zone would extend from the surface waters to the bottom waters of the reservoir. Therefore, TVA believes that water quality conditions downstream of the dam would not significantly change based on this larger withdrawal zone associated with the proposed action.

Although the flow rate through the dam would increase with the new turbines, it is not believed that this increase would result in lowering the water temperatures or dissolved oxygen in the tailwaters. Conversely, it is believed that these conditions would be offset to some degree by the increased aeration and associated mixing resulting from the faster flowing water.

The water quality in Wilson Reservoir and in the tailwaters is not expected to be significantly impacted because the total amount of water to be released each day will not change with the turbine upgrade. The increased flow rate will not change average daily pool elevations or the detention time of water within the reservoir. However, variations in the flow rate and surface elevation within the day would occur over a slightly shorter period of time in the tailwaters.

Species' response to a proposed action

The Service currently has no population estimates on the seven endangered mussel species being addressed in this opinion. However, surveys have been completed for each of these species and distribution information gathered through the years (see Appendix A.). It has been well established and generally accepted among biologists that each of these species' range (distribution) has been severely impacted by the impoundment of the Tennessee River. Certain segments of the Tennessee River sustain populations of these species; however these populations are, in most instances significantly impaired as compared to historical levels. The reason for their impairment stems from a variety of conditions; such as, poor water quality, sedimentation, and pesticide/herbicide/nutrient enrichment. Another factor affecting mussels is the all-important need for their glochidia to attach to a fish host. Once they have found the suitable fish host, the metamorphosed juveniles then must detach, and if, fortunate enough, land in suitable habitat to continue to survive (see more on mussel life cycle in the Environmental Baseline section above).

Given the intricacies of the mussel's life cycle, their sedentary nature, and their individual requirements for habitat type and fish host; these species are extremely limited in their ability to disperse and are very vulnerable to changes in their environment. Because their ranges are so limited and they are sedentary, these animals are highly vulnerable to natural catastrophic events such as floods. Also, human-related point and non-point source pollution that could occur in an upstream or upslope location (i.e. chemical or hazardous fuel spill, pesticide run-off) are potential threats to these species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future

Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under Section 7 of the Act.

The area in which the proposed action will be conducted is currently being affected by a variety of actions and activities. A major urban area (Florence-Muscle Shoals) exists in the vicinity of the action area; this area is likely affecting the species and habitats within the mainstem of the Tennessee River and its tributaries. Large recreational boats and barge traffic that move upriver and downriver through the action area likely have some effect on aquatic species and habitats; propeller wash creates waves that erode the riverbanks, resulting in sediment deposit on the river bottom. Runoff from adjacent agricultural fields may contain fertilizers and/or pesticides that can affect aquatic organisms. Residential, commercial, and industrial development around the tailwaters of Wilson Dam and within Pickwick Reservoir, particularly those located near the cities of Florence, Muscle Shoals, Tuscumbia, and Sheffield, Alabama, has increased over time and is likely to continue; resulting in destruction or alteration of aquatic and terrestrial habitats. These effects have occurred over many years and are likely to continue.

CONCLUSION

Although mussels in Wilson Dam tailwaters may be impacted by the upgrading of turbines in the dam, it is expected the mitigation efforts TVA proposes to employ (e.g. use of riprap to stabilize eroding shoreline) would offset adverse effects of increased flow rates and potential bank erosion in this reach of the Tennessee River.

After reviewing the current status of cracking pearlymussel, fanshell, orangefoot pimpleback, pink mucket pearlymussel, ring pink, rough pigtoe pearlymussel, and white wartyback pearlymussel; the environmental baseline for the action area; the effects of the proposed Wilson HMOD project; and the cumulative effects; it is the Service's biological opinion that the Wilson HMOD project, as proposed, is not likely to jeopardize the continued existence of these 7 mussel species. No critical habitat has been designated for these mussels, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation under Section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. *Harm* is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. *Harass* is defined by Service as intentional or negligent actions that create the likelihood of injury to listed

species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by TVA so that they become binding conditions of the Wilson HMOD project for the exemption in Section 7(o)(2) to apply. TVA has a continuing duty to regulate the activity covered by this incidental take statement. If TVA fails to accept and implement the terms and conditions, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, TVA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR ∋402.14(I)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Presently, TVA can not provide the Service with enough site-specific data on which locations of riverbank and island shoreline would be affected by the increase in flow rates. In addition, the timing, extent, and location of the individual shoreline stabilization activities resulting from these increased flows are not known at the present time. Therefore, the Service believes the most efficient and appropriate means of addressing potential adverse impacts to listed species is to conduct this programmatic biological opinion. This programmatic biological opinion estimates the total take for the entire program based on TVA's estimation of all future shoreline stabilization activities associated with the proposed hydroturbine modernization; however each individual shoreline stabilization activity will be subsequently analyzed as the location and extent of the activity becomes known. In order for the individual stabilization actions to occur, each action must meet the program design standards set forth in the reasonable and prudent measures and terms and conditions of this opinion. As individual projects are proposed and analyzed individually as to their effect on listed mussels and this analysis, they will be appended to the programmatic incidental take statement as appropriate. In addition, the total incidental take for all individual stabilization activities will be tracked cumulatively to allow the Service to determine if the overall programmatic estimate of incidental take has been reached (or exceeded).

In estimating the program level of incidental take, the Service assumes the standards (guidelines) developed by TVA for shoreline stabilization efforts in areas designated as archaeological sites downstream from TVA dams will be strictly followed. It is these guidelines that TVA would prefer to utilize for future stabilization efforts located downstream of Wilson Dam.

The Service expects incidental take will be difficult to detect for the cracking pearlymussel, fanshell, orangefoot pimpleback, pink mucket pearlymussel, ring pink, rough pigtoe pearlymussel, and white wartyback pearlymussel for the following reasons: (1) their early life stages are very small and difficult to find; (2) these mussels spends their entire lifetime burrowed into the substrate in large rivers; when an individual dies, it likely remains in place, thus finding a dead individual would be unlikely unless the river was periodically monitored by divers; (3) attributing death of an individual mussel to the upgrading of hydro turbine units and subsequent bank stabilization efforts under the preferred alternative would be difficult; (4) these mussels are rare; individuals are generally scattered randomly over the river bottom in areas containing suitable habitat; finding an individual, live or dead, typically requires intensive searching.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary to reduce incidental take of the aforementioned endangered mussels from the proposed shoreline/bank stabilization efforts:

1. The essential means of reducing impact to the endangered mussels is to avoid known locations of these animals altogether. When avoidance is not possible, actions to minimize the impact to mussels would be implemented. When TVA personnel determine a known mussel bed would be impacted by shoreline stabilization efforts, TVA would implement a salvage/relocation effort for all federal-listed mussels. Mussels would be relocated to a suitable habitat.
2. Minimization of siltation of aquatic habitats. Measures will be employed to prevent sedimentation of the river to the maximum extent possible. When barges and tugboats are utilized, reduce the extent of the prop wash from stirring up the bottom substrates and habitats that may contain listed mussel species.
3. Measures will be employed to minimize the potential for degradation of water quality.
4. Minimization of riverbank and river island vegetation removal.
5. Use of Best Management Practices during all phases of riverbank and island shoreline stabilization efforts.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the Act, TVA must comply with the following terms and conditions, which carry out the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Implement appropriate preventive measures to minimize the potential for hazardous materials (e.g. hydraulic fluid, oils, lubricants, fuel) from leaking onto the ground or into the water. Have in-place a Hazardous Material/Fluid Spill Prevention Plan to address accidental spills/leaks.

2. In instances when riprap would need to be placed below low winter pool elevation to properly protect the bank, TVA malacologists would conduct a site tour of these locations to determine potential impacts of this action on mussel species. If visual observations can not conclude the absence of listed mussel species in or near the footprint of the riprap placement, a mussel presence/absence survey would be necessary. These surveys would need to be conducted by divers and biologists familiar with the listed species discussed in this biological opinion. The survey protocol guidelines are provided and attached as Appendix B and are to be strictly implemented.

3. TVA and Service biologists would mutually agree on at least two mussel relocation sites prior to implementation of the proposed project. These sites would have an established mussel population and would exhibit the habitat features needed to sustain the 7 listed mussel species that would be relocated to these areas.

4. When stabilization activities are deemed necessary, or are to occur, between TRM 249.0 and TRM 250.0, the Service would need to be contacted in advance of any work for assistance in properly positioning the barge and tug boat to prevent disturbance of the NEP (or "pilot") populations located in this reach (i.e. Buck Island Chute area).

5. TVA is required to report to the Service project-specific information of their proposed actions and site-specific areas to be affected by their actions (i.e. provide location of project site, extent of impact area, and anticipated impacts of stabilization activities on listed mussels). This report would be appended to the program-level biological opinion utilizing the format found in Appendix C.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the U.S. Fish and Wildlife Service Law Enforcement Office (Mr. Garry Phillips, Senior Resident Agent), Montgomery, Alabama; telephone 334/285-9600. Additional notification must be made to the Service's Daphne Ecological Services' representative located at Wheeler National Wildlife Refuge (Mr. Rob Hurt, Biologist); telephone 256/353-7243. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury. In conjunction with care of sick or injured endangered and/or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than 20 pink mucket pearlymussels; 2 orangefoot pimplebacks, 2 rough pigtoe pearlymussels, 2 white wartyback pearlymussels, 2 fanshells, 2 cracking pearlymussels, and 2 ring pink mussels will be incidentally taken. The Service understands no more than 80 acres of river bottom substrate would be impacted during the implementation of riverbank and island shoreline stabilization activities. If, during the course of the action, this level of incidental take is exceeded on any one listed mussel species, or greater than 80 acres of river bottom is disturbed, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The TVA must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that this provision of the ESA places an obligation on all Federal agencies to implement positive programs to benefit listed species, and a number of recent court cases appear to support that belief. Agencies have some discretion in choosing conservation programs, but Section 7(a)(1) places a mandate on agencies to implement some type of programs.

We recommend that TVA implement the following conservation measures:

1. Participate actively in ongoing efforts to restore native mussel populations. Ongoing research efforts include development of techniques for long-term holding of mussels in captivity; captive propagation of mussels; and re-introduction of propagated mussels into historic habitats. The objective of these efforts is to restore native mussel populations and to recover those that are currently listed as endangered, threatened and those currently on the list of candidate species.
2. Continue to actively participate in survey efforts to identify known locations of endangered, threatened, and candidate species within TVA jurisdiction. These efforts would further our understanding of mussel population dynamics and aid in TVA's future project planning efforts within the Tennessee River.

3. Take a lead role in the development of new design and construction technologies and methodologies. Utilize in-house engineers to begin looking at current engineering practices and developing new ones to benefit aquatic fauna. Use of new technologies may make it possible to design and construct bank stabilization projects in a manner that eliminates adverse impacts to aquatic habitat. New and better means of controlling sediment are needed. Development of new methods, technology, and equipment may eliminate the need to remove large amounts of vegetation along streams. Application of new technologies through bioengineering stream bank stabilization may eliminate the need, delivery, and use of expensive rock rip-rap materials. Such innovations would be of tremendous benefit to native mussel populations and other aquatic species.

4. Implement a detailed water quality monitoring effort within the Tennessee River, particularly monitoring water quality conditions downstream of Wilson Dam to determine the year-round affects of the turbine modernization program at this facility.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

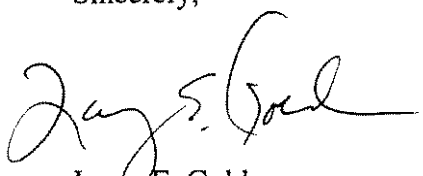
RE-INITIATION - CLOSING STATEMENT

This concludes formal consultation on the action outlined in the consultation request. As provided in 50 CFR Sec. 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified to include activities that cause an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

For this biological opinion the incidental take would be exceeded when more than 80 acres of river bottom substrate is disturbed during riverbank and island shoreline stabilization efforts and/or when more than 20 pink mucket pearlymussels; 2 orangefoot pimplebacks, 2 rough pigtoe pearlymussels, 2 white-wartyback pearlymussels, 2 fanshells, 2 cracking pearlymussels, and 2 ring pink mussels are taken; which is what has been exempted from the prohibitions of section 9 by this opinion. The Service appreciates the cooperation of TVA personnel during this consultation. We would like to continue working with you and your staff regarding the Wilson

HMOD project. For further coordination please contact Mr. Rob Hurt of my staff at 256/353-7243.

Sincerely,



Larry E. Goldman
Field Supervisor

cc: Tennessee Valley Authority, Ms. Peggy Shute, Knoxville, TN
Tennessee Valley Authority, Ms. Stephanie Chance, Knoxville, TN
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Appendix A.

Species Accounts

Lemiox rimosus (Rafinesque 1831)
Birdwing Pearlymussel

The **birdwing pearlymussel** (*Lemiox rimosus*) was listed as a federal endangered species (as *Conradilla caelata*) in 1976 (USFWS, 1976). The original range of this species apparently was limited to the Tennessee River and several of its tributaries (USFWS 1983, Parmalee and Bogan 1998). Since the early 1970s, the birdwing has been found alive in the Clinch, Duck, Elk, and Powell rivers (USFWS 1983, Neves 1991). This species is rare to extremely rare in most of these rivers; however, it is relatively common in a short reach of the Duck River (Jenkinson 1988). As of 2000, the U.S. Fish and Wildlife Service considered this species to be declining (USFWS 2003); however, the results of quantitative sampling in the Duck River (Aquatic Resources Center 1997) and recurring occasional encounters in other rivers suggest that at least most populations of this species are stable. The reasons for the decline of this species are not totally understood, but impoundments, siltation, and pollution are speculated to be the major causes (USFWS 1983). Critical habitat has not been identified for this species.

In 1982, TVA transplanted members of this species from the Duck River to sites on the Buffalo, Nolichucky, and North Fork Holston rivers, and to a site on the upper Duck River (Jenkinson 1983). Results of monitoring studies indicate that the numbers of transplanted animals declined to very low levels at all four sites; however, the recovery of a few young individuals suggests the introduced birdwings successfully reproduced in both the North Fork Holston and Nolichucky rivers (Aquatic Resources Center 1994, Aquatic Resources Center 1996). In 2001, the U.S. Fish and Wildlife Service included the birdwing pearlymussel in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (USFWS 2001). During 2003-2004, this species was reintroduced into that reach of the Tennessee River. No data currently exists on the success of this effort. However, future surveys would verify if these reintroductions result in reproducing populations of this endangered species.

The birdwing occurs in fast-flowing water with stable, gravel or cobble substrates, typically but not always in riffles (USFWS 1983). Two fish hosts have been identified: banded darter (*Etheostoma zonale*) and greenside darter (*Etheostoma blennioides*) (TVA 1986).

In recent years, the birdwing has been encountered in four waterbodies in the Tennessee River: in the Duck River both downstream from the City of Columbia Dam and between Columbia and

Shelbyville, and in the Elk River both downstream from Fayetteville and between Fayetteville and Tims Ford Dam. In three of these waterbodies, the birdwing was represented by single individuals; however, the species is abundant in the Duck River not far upstream from Columbia. The birdwing is considered to typically occur in small rivers and large creeks.

Dromus dromas (Lea 1834)
Dromedary Pearlymussel

The **dromedary pearlymussel** (*Dromus dromas*) was listed as endangered in 1976 (USFWS 1976). The original distribution of this species included upstream parts of the Cumberland and Tennessee rivers and several of their eastern tributaries (USFWS 1984). In recent years, the dromedary has been found in part of the Cumberland River in middle Tennessee, in one area on the mainstem Tennessee River in east Tennessee, and in the Clinch and Powell rivers in northeast Tennessee and southwest Virginia. Recent reproduction has been documented only in the Clinch and Powell river populations. The reasons for the decline of this species are not totally understood but impoundments, siltation, and pollution are speculated to be the major causes (USFWS 1984). The Clinch River population of this species may be relatively stable; however, the Powell River population and, especially, the few individuals remaining in the mainstem Tennessee River are declining. The overall trend for this species appears to one of decline (USFWS 2003). Critical habitat has not been designated for this species.

In 2001, the U.S. Fish and Wildlife Service included the dromedary pearlymussel in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (USFWS 2001). During 2003-2004, this species was reintroduced into that reach of the Tennessee River. No data currently exists on the success of this effort. However, future surveys would verify if these reintroductions result in reproducing populations of this endangered species.

The dromedary pearlymussel typically occurs in moderate- to fast-flowing current in clean-swept rubble, gravel, and sand substrates (Ahlstedt 1984). Fish hosts for this species in the wild have not been determined; however, laboratory infection studies have indicated that at least ten fish species can carry the glochidia through transformation. Most of these possible fish hosts are darters in the genera *Percina* and *Etheostoma* (Jones and Neves 2001).

Within the last 30 years, the dromedary pearlymussel has been found in only one of the waterbodies in the Tennessee River. Four individuals were encountered on the mainstem Tennessee River in the Watts Bar Dam tailwater: three in 1978 and one in 1983 (Gooch, et al. 1979; TVA 1986). This species is considered to occur, typically, in rivers and large creeks.

Epioblasma capsaeformis (Lea 1834)

Oyster Mussel

The **oyster mussel** (*Epioblasma capsaeformis*) was added to the federal endangered species list in 1997 (USFWS 1997). The historic range of this species included much of the Cumberland River system downstream from Cumberland Falls and all of the Tennessee River system upstream from the Muscle Shoals (USFWS 1998). Since the early 1970s, the oyster mussel has been found alive in Buck Creek and the Big South Fork within the Cumberland River basin, and in the Clinch, Duck, Little, Little Pigeon, Nolichucky, North Fork Holston, Paint Rock, Powell, and Sequatchie rivers in the Tennessee River basin (USFWS 1998). This species appears to suffer from population declines wherever it occurs (USFWS 2003a, 2003b). Six units of critical habitat have been proposed for this species: 46 miles of the Duck River, 94 miles of the Powell River, approximately 171 miles of the Clinch River and its major tributaries, 5 miles of the mainstem of the Nolichucky River, 95 miles of the mainstem of Big South Fork and its tributaries, and 36 miles of Buck Creek (USFWS 2003a).

The identified potential causes of the decline in this species include impoundment, pollution, siltation, adverse impacts of coal mining, and poor land use practices (USFWS 1994). In 2001, the U.S. Fish and Wildlife Service included the oyster mussel in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (USFWS 2001). During 2003-2004, this species was reintroduced into that reach of the Tennessee River. No data currently exists on the success of this effort. However, future surveys would verify if these reintroductions result in reproducing populations of this endangered species.

The oyster mussel typically occurs in gravel and sand habitats within shallow riffles (Parmalee and Bogan 1998). Identified fish hosts include the banded sculpin (*Cottus carolinae*), wounded darter (*Etheostoma vulneratum*), dusky darter (*Percina sciera*), and redline darter (*Etheostoma rufilineatum*) (Yeager and Saylor 1995).

This species is only known to occur within one waterbody in the Tennessee River: the Duck River between Shelbyville and Columbia. Two live oyster mussels have been found recently in the Nolichucky River not far upstream from the full pool limit of Douglas Reservoir; however, a small water supply impoundment separates the flowing part of the river from the larger impoundment. In this evaluation, the oyster mussel is considered to occur typically in small rivers and large creeks.

Athearnia anthonyi (Redfield 1845)
Anthony's Riversnail

Anthony's riversnail (*Athearnia anthonyi* = *Leptoxis crassa anthonyi*) was added to the list of federal endangered species in 1994 (USFWS 1994). This species, once relatively widespread in the Tennessee River system, was associated with shoal areas on the mainstem and some tributaries in Tennessee, Georgia, and Alabama. While it did occur in smaller streams, Anthony's riversnail was primarily found in big river habitats. Now, it is often found on large submerged rocks or logs, or on gravelly substrate in relatively shallow, moderately to fast flowing water, but has been reported from impounded reaches of the Tennessee River (USFWS 1997). The historical range of Anthony's riversnail extended from the Tennessee River system above Knoxville, Tennessee downstream to Muscle Shoals, Alabama. Many populations of this species have been eliminated as a result of impoundment and a general deterioration of water quality from siltation and other pollutants (USFWS 1997). No status surveys have been conducted for this species; however, the presence of juveniles and substantial numbers of adults where it occurs support the conclusion that the surviving populations are stable (USFWS 2003). Critical Habitat has not been designated for this species.

In 2001, the U.S. Fish and Wildlife Service included Anthony's riversnail in a proposal to establish nonessential experimental populations of several native mollusk species in riverine habitat just downstream from Wilson Dam (USFWS 2001). During 2003-2004, this species was reintroduced into that reach of the Tennessee River. No data currently exists on the success of this effort. However, future surveys would verify if these reintroductions result in reproducing populations of this endangered species. Potential threats to this species include siltation, direct loss of habitat, altered water chemistry and chemical pollution (USFWS 2000).

Anthony's riversnail is presently known from only two populations. One population is found in the downstream part of the Sequatchie River and the Nickajack Dam tailwater on the mainstem Tennessee River. The other occurs in Limestone Creek, extending downstream to the full pool level on Wheeler Reservoir. Anthony's riversnail is considered to occur in large river to small creek habitats.

Appendix B.

Criteria for Rare Mussel Survey

1. Sampling is recommended between May 1 and October 31 only. This is for the protection of the mussels. Also, cold weather and /or high water levels are more likely to occur before May and after October. Preferably, mussel surveys would be conducted within two weeks prior to riverbank and/or island shoreline stabilization efforts.
2. Transects should be established throughout the "impact area" of the action (the impact area is defined as all areas that will be directly or indirectly affected by the action, not just the actual site of the action).
3. Transects should be set perpendicular to river flow and spaced not more than 100 meters apart; the transects should be long enough to cover the action area and a reasonable buffer. If no mussels are found along 2 adjacent transects, a spot dive will be done between the transects; this will consist of a timed dive and a qualitative search for any mussels that can be seen or felt. If mussels are found in densities greater than 1 per square meter along two adjacent transects or during spot dives, additional transects will be established between the two and survey methods below will be applied. We recommend that areas of high mussel density (i.e. mussel "beds") be delineated and mapped.
    a. Divers should swim along each transect and collect all mussels seen along, and within arm's reach on either side of the transect. Areas along transects consisting of mud, silt, or detritus, and areas with hardpan or bedrock need not be searched intensively. Effort should be concentrated in areas with stable, mixed sand/gravel/cobble substrate.
    b. All mussels collected should be placed in mesh bags and brought to the surface for identification. Bags containing mussels awaiting processing will be kept in the river. If processing of mussels is delayed or interrupted, any mussels on board boats or on shore will be placed into mesh bags and placed back into the river.
    c. The survey should begin no less than 10 meters upstream from the impact area and extend downstream far enough, at least 20 meters, to cover the area that might be impacted. Depending on the slope and water depth adjacent to the bank and the anticipated impact, we generally recommend that the survey extend at least 20 meters perpendicular to the shoreline.
    d. The survey should be conducted by a biologist familiar with the mussel fauna – i.e. identification of species, biology, and ecological requirements of the species, sampling methods, handling individuals in a way that minimizes stress and/or mortality. The biologist should possess a valid Federal and State collection permit.

e. All mussels collected should be identified to species. Federally listed and candidate mussels collected should be measured, and age and sex determined. If a camera is available, those individuals should also be photographed. When this is completed, all Federally listed mussels should be returned to the river, released at the predetermined mussel relocation site. If numbers of mussels are not too high, all mussels should be hand-placed into the suitable substrate at the relocation site; if high numbers of mussels are collected (i.e. thousands), at least the Federally listed mussels should be carefully hand-placed into the substrate. If mussels must be moved long distances to the relocation site, they should be placed in buckets or tanks with aerated river water, or wrapped in moist cloth and placed into coolers with ice. We generally recommend post-relocation monitoring to determine if relocated mussels survive.

f. Survey results should be compiled and incorporated into the biological assessment for the individual riverbank and/or island shoreline stabilization project site and these results submitted to the Service for review.

Appendix C.

Appended Consultation Document Format

The following document format (see below) would be used by TVA to describe project-specific information of their proposed action and the site-specific areas to be affected by their action. The document would identify the species and critical habitat that may be affected. (In the case of the proposed Wilson HMOD project, there are currently no critical habitat designations for the seven listed mussel species identified in this programmatic biological opinion; therefore no critical habitat would be impacted by this project.) Moreover, the document would describe the anticipated effects to listed species, specifying, if appropriate, that the anticipated effects from the proposed action are consistent with those anticipated in the program-level biological opinion. The document would further describe any additional effects, if any, not considered in the programmatic consultation.

To initiate project-specific review, TVA's project information and effects analysis should be accompanied by a cover letter specifying that TVA has determined the proposed project is consistent with the program-level biological opinion and reasonable and prudent measures and associated terms and conditions, if any. The cover letter should also request the proposed project be appended to the program-level biological opinion and associated incidental take statement, if appropriate, to fulfill TVA's consultation requirements.

The cover letter and accompanying appended consultation document developed by TVA would be sent to the Service for review. Upon final review and determination by the Service, this information would be physically attached to the program-level biological opinion in an appendix (Appendix D).

Project-level review documents should contain the following elements:

(1) Introduction. Explain the relationship between the program-level biological opinion and the project-level review document and identify any additional information used to create the review document.

(2) Project Description. Provide a short project summary.

(3) Status of the Species and Environmental Baseline. Reference baseline information provided in program-level biological opinion.

(4) Effects Analysis. Include detailed description of the effects of the action on listed species, specifying what the proposed action will do to both individuals of the listed species affected and to the surrounding environment. When practicable, utilize information provided in the program-level biological opinion, i.e. TVA should reference discussions in the program-level biological opinion that specifically mentions effects of the proposed action on listed species. Present any additional information on how the

species and habitat will be affected by this specific project and how these impacts will affect the species' conservation. Generally, this section must sufficiently assess specific effects of the individual proposed project on the listed species.

(5) Conclusion. In this section, TVA provides the Service with their rationale of how their site-specific project falls within the requirements ("sideboards") provided in the program-level biological opinion and accompanying incidental take statement.

Appendix D

Appended Consultation Documentation